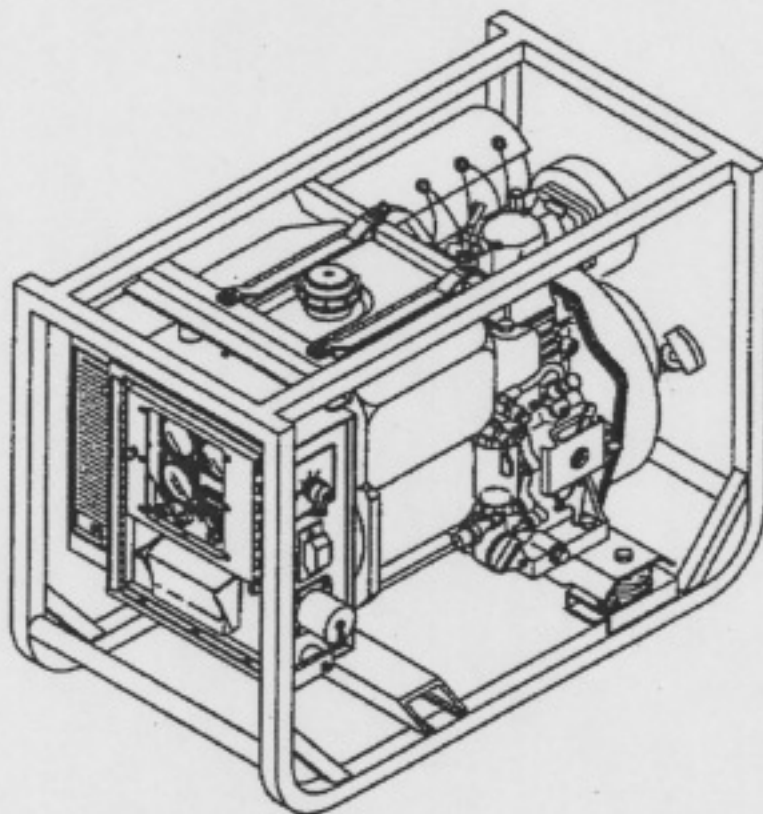


**SUPPLEMENTARY MBU TRAINING MATERIAL
OPERATOR COURSE FOR
THE 2 kW MILITARY TACTICAL GENERATOR SET
MEP-531A-120 VAC, 60 HZ**

INSTRUCTOR GUIDE



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Prepared for
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NATICK, MA

WARNING SUMMARY

WARNING

High Voltage is produced when this generator set is in operation. Use care when working around an open control panel with the generator set operating. Improper operation and/or failure to follow this warning could result in personal injury or death by electrocution.

WARNING

Never attempt to start the generator set if it is not properly grounded. Failure to observe this warning could result in serious injury or death by electrocution.

WARNING

Never attempt to connect or disconnect load cables while the generator is running. Failure to observe this warning could result in severe personal injury or death by electrocution.

WARNING

DC voltages are present at generator set electrical components even with generator set shutdown. Avoid grounding self when touching any electrical components. Failure to observe this warning can result in personal injury.

WARNING

The fuels in this generator set are flammable. Do not smoke or use open flame when performing maintenance. Flames and explosion could result in severe personal injury or death.

WARNING

Hot fueling of generators while they are operating presents a safety hazard and should not be attempted. Hot engine surfaces and sparks produced from the engine and generator circuitry are possible sources of ignition. Failure to observe this warning could result in severe personal injury or death.

WARNING

Exhaust discharge contains deadly gases. Do not operate generator set in enclosed area unless exhaust discharge is properly vented outside. Position as far away from personnel, shelters, and occupied vehicles as possible. Failure to observe this

warning could result in severe personal injury or death due to carbon monoxide poisoning.

WARNING

Liquids under pressure are generated as a result of operation of the generator set. High-pressure leaks could cause severe personal injury or death.

WARNING

Avoid contacting metal items with bare skin in extreme cold weather. Failure to observe this warning can result in personal injury.

WARNING

Remove metal jewelry when working on electrical system/components. Failure to observe this warning could cause severe personnel injury from electric shock.

WARNING

The noise level of this generator set when operating could cause hearing damage. Hearing protective devices must be worn when operating or working within 13 feet of the generator set when it is running. Failure to observe this warning can result in personal injury.

WARNING

Most cleaning solvents are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Good general ventilation is normally adequate.

WARNING

When using compressed air, wear protective glasses and use clean, low-pressure air, 30 psi (206.8 kPa) maximum. Failure to follow these instructions could result in eye injury.

WARNING

When changing/draining oil, use chemical splash goggles to protect eyes.

WARNING

Proper Personal Protection Equipment (PPE) must be used in accordance with OSHA Regulation 29 CFR 1926.62 to protect employees from adverse health

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GENERATOR SET DESCRIPTION

A. Equipment Characteristics, Capabilities, and Features.

1. General: The 2kW generator set, Model 531A, is a self-contained, skid-mounted, portable unit. It is equipped with controls, instruments and accessories necessary for operation as a single unit. The generator set consists of a diesel engine, direct drive AC alternator, speed governing system, fuel system, 24 VDC auxiliary cold weather starting system, and a generator control system. The generator is portable and requires a four-person lift.

B. Location and Description of Major Components.

1. Diesel Engine: The generator set is powered by a one cylinder, four cycle, fuel injected, naturally-aspirated, air-cooled diesel engine which occupies the front half of the generator set. The engine is also equipped with a fuel filter, lubricating oil strainer, and a foam covered dry-paper air filter.
2. Alternator: The AC alternator is a single-bearing, drip-proof, synchronous, single phase, air-cooled generator. The set output is 120 VAC.
3. Control Panel Assembly: The generator set control panel assembly is located at the rear of the generator set and contains controls and instruments for operating the engine and the alternator.
4. Fuel Tank: The 1.6 gallon fuel tank is located on top of the generator set just behind the diesel engine. The tank includes a removable strainer element designed to prevent large contaminants from entering the tank through the fill opening. The tank has sufficient capacity to enable the generator set to operate for at least 3.6 hours without refueling while operating at 100% load.
5. Skid Base: The skid base supports the generator set.

6. Safety Devices:

- a. The generator set features a Low Oil Pressure shutoff switch and solenoid which are designed to shut down the generator set if the diesel engine loses oil pressure.
- b. The convenience receptacle on the generator set features a Ground Fault Circuit Interrupter, which protects the generator set components from inductive current in the ground circuit originating from the load connected to the convenience receptacle.
- c. The ON-OFF load circuit breaker is designed to take the generator set off line in an overload condition.
- d. A circuit interrupter is connected between the alternator output and the generator set output terminals to disconnect the generator output from the load and also to protect the generator from a short circuit. The circuit interrupter is operated from a current sensor internal to the circuit breaker.

DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

A. Controls and Indicators.

1. Recoil Starter: When the Recoil Starter is pulled, it turns over the engine flywheel/crankshaft to start the diesel engine.
2. Air Intake Cover: The Air Intake Cover directs air flow into the engine air intake system. In cold weather, the cover is positioned to allow air, which has been warmed by the hot muffler to flow into the diesel engine air intake system. Normally, the cover is positioned to allow ambient air to flow into the diesel engine.
3. Decompression Lever: When the Decompression Lever is depressed, it releases compression in the diesel engine combustion chamber to allow for manually pull starting the engine. The lever automatically returns to its up position when the recoil starter is pulled.
4. Run Lever: The Run Lever enables fuel flow to the diesel engine fuel injection pump for starting and running the generator set when it is pushed.
5. Stop Lever: By depressing the Stop Lever, fuel flow is disabled to the diesel engine fuel injection pump to stop the engine.
6. Fuel Shutoff Valve: In the open position, fuel flows from the fuel filter to the diesel engine fuel injection pump. In the closed position, fuel flow is stopped from the fuel filter to the diesel engine fuel injection pump.
7. Fuel Filter Bleed Screw: The Bleed Screws are used to bleed air from the generator set fuel system.
8. Oil Fill Cap/Dipstick: The Oil Fill Cap/Dipstick is used to check and add lubrication oil to the diesel engine. There is one on each side of the engine.
9. START-PREHEAT/PREHEAT/OFF/START Switch: The four-position switch enables the starter to engage and/or the air intake heaters to energize for cold weather starting. The switch needs 24 VDC to operate.
10. ON-OFF Load Circuit Breaker: In the on position the circuit breaker supplies AC power to the load terminals. In the off position the circuit breaker shuts off AC power to the load terminals.

11. NATO Slave Receptacle: The Slave Receptacle supplies power to the diesel engine start and air intake heater circuits when connected to a external 24VDC power source via the NATO power cable.
12. Voltmeter: The Voltmeter indicates output voltage of the generator set. Normal reading for the generator in 120 VAC.
13. % LOAD Meter: The % LOAD Meter indicates the generator set load current as a percent of its rated current. Normal reading is dependent on load demand from 0 to 125 percent.
14. HOUR Meter: Total diesel engine operating hours are indicated by the HOUR Meter.
15. Voltage Adjust Potentiometer: Generator set voltage is adjusted from 114 VAC to 126 VAC with the Potentiometer.
16. GFCI Receptacle: The receptacle provides 15 Amp, 120 VAC power. It features a GFCI, which protects the generator set from power surges originating from powered equipment and two grounded convenience receptacles. It also features a press to test button.
17. Fuse: The fuse protects the voltmeter and frequency meter during an over-current condition. Spare fuse is contained in a fuse holder to the left of the primary fuse.
18. Hertz Frequency Meter: The meter indicates generator set output frequency. This meter may also be used to determine the engine rpm by multiplying the reading by 60 (e.g. 60 Hertz x 60 = 3600 rpm). Normal reading is 60 hertz.
19. Load Terminals: Connection points for the load cables are provided by the Load Terminals. These are the split lug connectors "L" and "N".
20. Ground Stud: The Ground Stud is a suitable ground location for grounding the generator set.

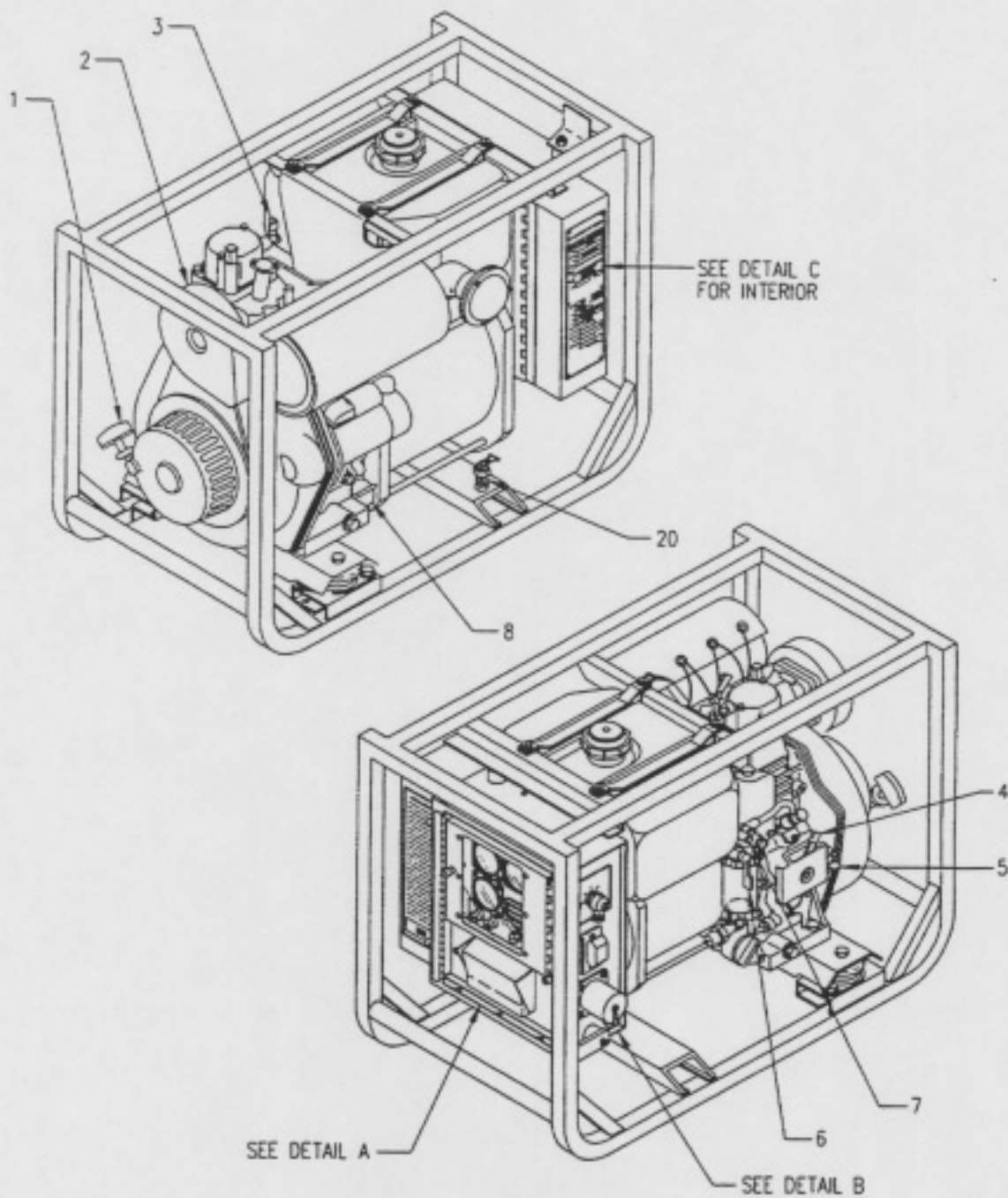
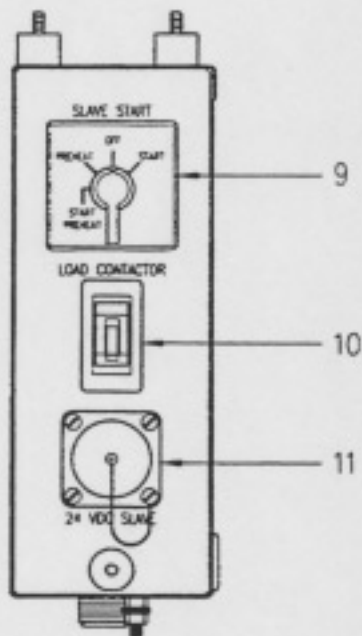
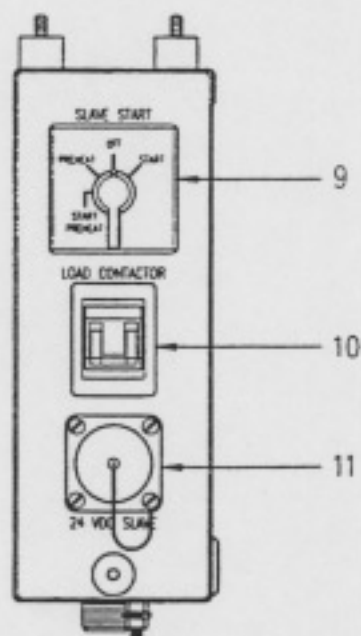


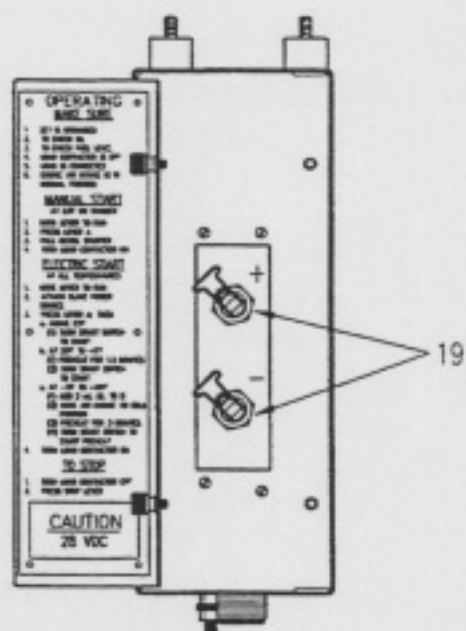
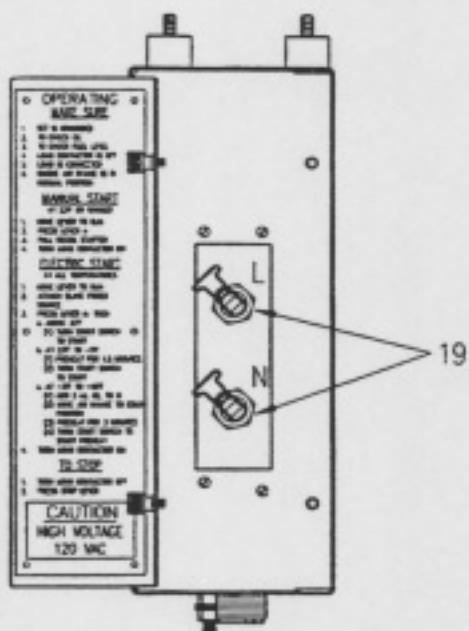
Figure 1-1. Controls and Indicators (Sheet 1 of 3)



DETAIL B
MEP-531A



DETAIL B
MEP-501A



DETAILS B/C

Figure 1-1. Controls and Indicators (Sheet 2 of 3)

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

A. General.

Preventive Maintenance Checks and Services (PMCS) are those scheduled procedures, which are essential to the efficient operation of the equipment. PMCS prevent possible damage that might occur through neglect or failure to observe warning symptoms on time. Ensure all noted discrepancies are corrected.

B. Description of Columns.

1. Item Number: This column contains a number for each procedure to be performed. When reporting malfunctions or failures on DA Form 2404, or DA Form 5988E enter this number in the "TM Item No." column.
2. Interval: These columns tell when to perform a procedure. A dot in a column tells which procedures apply. Some procedures will have more than one dot. B-Before/D-During/A-After.
3. Item To Be Inspected: This column has the name of the item to be inspected.
4. Procedure: This column tells how to do the required checks and services. Carefully perform these instructions in the order listed.
5. Equipment Is Not Ready/Available If: This column states conditions that will cause the equipment not to be ready for operation.

C. Preventive Maintenance Procedures.

Within designated intervals, these checks are to be performed in the order listed. If the generator set must be kept in continuous operation, check and service only those items that can be accessed without interrupting operations. Complete checks and services when the generator set is shut down.

1. Before: In performing the Before checks observe all Warnings and Cautions contained in the manual and on plates installed on equipment.
2. During: In performing the During checks observe all Warnings and Cautions contained in the manual and on plates installed on equipment.
3. After: In performing the After checks observe all Warnings and Cautions contained in the manual and on plates installed on equipment.
4. Classifying leaks during PMCS. Class I, II, III.

OPERATION UNDER USUAL/UNUSUAL CONDITIONS

A. Assembly and Preparation for Use.

1. Installation of Ground Rods
2. Installation of Load Cables
3. Priming and Bleeding the Fuel System

B. Initial Adjustments and Checks.

The diesel engine must be broken-in, avoiding heavy loads, for a period of at least twenty hours to ensure proper operation of the generator set. After the initial break-in period, the intake and exhaust valve clearances must be checked and adjusted, the head nuts torque must be checked, and engine lubricating oil changed. Contact unit maintenance.

C. Operating Procedures.

1. Manual Starting (23 to 122 degrees)
2. Electric Starting (23 to 122 degrees)
3. Electric Starting (23 to -5 degrees)
4. Electric Starting (-5 degrees and below)
5. Stopping procedure
6. Preparation for movement
7. Operation in Extreme Cold (23 to -51 degrees)
8. Operation in Extreme Heat (120 degrees plus)
9. Operation in Dusty or Sandy Areas
10. Operation in Rainy or Humid Conditions
11. Operation in Salt Water Areas
12. Operation at High Altitudes
13. Nuclear, Biological, and Chemical Decontamination procedures

OPERATOR MAINTENANCE INSTRUCTIONS

A. Lubrication Instructions.

Lubrication is not required by the operator (crankcase oil is).

B. Troubleshooting.

Troubleshooting tables list common malfunctions that an Operator may find with the 2kW. Perform test, inspections, and corrective actions in the order they appear in the table. The Troubleshooting tables cannot list all the malfunctions that may occur, all the test and inspections needed to find the fault, or all the corrective actions needed to correct the fault. If the equipment malfunction is not listed or actions listed do not correct the fault, notify higher maintenance.

C. Operator Maintenance Procedures.

1. Fuse.

Appendix A
Leading Particulars

Leading Particulars

a. Generator Set.

Model Numbers:

2 kW 120 VAC Military Tactical Generator Set	MEP-531A
2 kW 28 VDC Military Tactical Generator Set	MEP-501A

National Stock Numbers:

MEP-531A	NSN 6115-01-435-1565
MEP-501A	NSN 6115-01-435-1567

Overall Length

MEP-531A	29.5 in. (750 mm)
MEP 501A	29.5 in. (750 mm)

Overall Width

MEP-531A	16 in. (406 mm)
MEP-501A	16 in. (406 mm)

Overall Height

MEP-531A	21.7 in. (550 mm)
MEP-501A	21.7 in. (550 mm)

Dry Weights

MEP-531A	140.2 lb (63.6 kg)
MEP-501A	123.5 lb (56.0 kg)

b. Operating Environment.

Temperature Range	-51 to 122° F (-46 to +50° C)
Incline Angle	15° max.

Lending Particulars

c. Diesel Engine.

Manufacturer	Yanmar
Model	L48AE-DEG
Type	Single cylinder, four cycle, naturally-aspirated diesel
Stroke	2.2 in. (55 mm)
Displacement	12.88 cu in. (0.211 l)
Compression Ratio	19.9:1
Rating	4.2 HP @ 3600 RPM
Engine Operating Speed	
No Load	3750 RPM
Full Load (\pm 30 RPM)	3600 RPM
Altitude Degradation, 4000 to 8000 ft	1.3% per 328 feet (100 m)
Cold Weather Starting System Use	When temperature is 23°F (-5°C) or below

d. Diesel Engine Cooling System.

Type Air Cooled by Fan Integral with Flywheel

e. Diesel Engine Lubricating System.

Type	Full flow, circulating pressure
Capacity	0.85 qt (0.80 l)
Oil Pump Type	gerotor
Normal Operating Pressure	25-60 psi
Filter Type	reusable strainer
Pressure Indicating System	None

f. Fuel System.

Type of Fuel	DL-1, DL-2, or JP8
Fuel Tank Capacity	1.2 gal. (4.6 l)
Fuel Consumption Rate	0.333 gal./hr (1.26 l/hr) @ 100% load
Full Tank Consumption	3.6 Hours @ 100% load

g. Diesel Engine Starting System.

Manual	Recoil Mechanism
Electric (Power supplied via NATO slave receptacle)	Starting Motor
Manufacturer	Yanmar
Model	S114-414A
Rating	24 VDC

Leading Particulars

h. Alternator.

MEP-531A:

Manufacturer	Dewey Electronics Corporation
Type	Rotating field synchronous
Load Capacity	2 kW
Voltage Output	120 VAC single phase
	2 wire and ground (bonded to frame)
Power Factor	1.0
Load Recovery Time (Voltage):	
NL to FL	3.0 seconds
FL to NL	3.0 seconds
Load Recovery Time (Frequency):	
NL to FL	4.0 seconds
FL to NL	5.0 seconds
Cooling	forced air
Lubrication Requirements	none
Drive Type	direct coupling
Duty Classification	continuous

MEP-501A:

Manufacturer	Balmar Products Inc.
Type	Brush AC Rectified to DC
Load Capacity	2 kW
Voltage Output	28 VDC
Load Recovery Time (Voltage):	
NL to FL	1.0 seconds
FL to NL	0.5 seconds
Cooling	forced air
Lubrication Requirements	none
Drive Type	direct coupling
Duty Classification	continuous

i. Safety Devices.

Low Engine Oil Pressure:

Trip Pressure (Range)	12-18 psi
Voltage Rating	24 VDC
Current Rating	5 amps
Method	Electrically-operated solenoid with mechanical link to fuel governor

Appendix B


Preventive Maintenance Checks and Services (PMCS) tables

Operator Preventive Maintenance Checks and Services



NOTE

Within designated intervals, these checks are to be performed in the order listed.


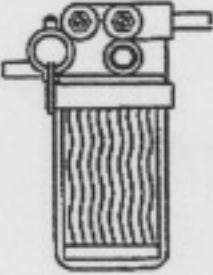
B-Before operation D-During operation A-After operation

(1) Item No.	(2) Interval			(3) Item To Be Inspected	(4) Procedure	(5) Equipment Is Not Ready/Available If:
	B	D	A			
(1)	*			GENERATOR SET Control Panel	Check ON-OFF load circuit breaker for damage. 	ON-OFF load circuit breaker damaged.
	*		*	Instrument Panel	Check window protecting instrument panel for damage.	Indicators or controls damaged or missing. VOLTS meter or HERTZ frequency meter (MEP-531A) inoperative.
	*		*		Check all indicators and controls for damage and missing parts.	
		*			Check all indicators for proper operation.	
(2)	*		*	Identification and Instruction Plates	Check all identification and instruction plates for damage, security, and legibility.	Safety or operation instruction decal missing or illegible.

Operator Preventive Maintenance Checks and Services

(1) Item No.	(2) Interval			(3) Item To Be Inspected	(4) Procedure	(5) Equipment Is Not Ready/Available If:
	B	D	A			
(3)	*			Load Terminals	<p>Inspect load terminals for damage and security.</p> 	Load terminals damaged or loose. Retaining clips missing or damaged.
(4)	*	*		Ground terminal stud	<p>Inspect ground terminal stud for damage. Ensure generator set is properly grounded.</p> 	Generator set ground terminal stud is damaged or generator set not properly grounded. Retaining clip missing or damaged.


Operator Preventive Maintenance Checks and Services

(1) Item No.	(2) Interval			(3) Item To Be Inspected	(4) Procedure	(5) Equipment Is Not Ready/Available If:
	B	D	A			
(5)	*			Air Intake Cover Wing Nut	<p>Check air intake cover wing nut for security. Tighten if necessary.</p> 	Air intake cover cannot be secured.
(6)	*		*	Filter Assembly, Fuel	<p>Inspect fuel filter assembly for damage and security. Check fuel filter bowl for water or other contaminants.</p> 	Fuel bowl contains water or contaminants.

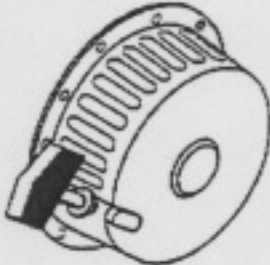
Operator Preventive Maintenance Checks and Services

(1) Item No.	(2) Interval			(3) Item To Be Inspected	(4) Procedure	(5) Equipment is Not Ready/Available If:
	B	D	A			
(7)	•	•	•	Fuel System	<p>Inspect fuel system for loose or missing fuel line clamps, damaged fuel lines, and leaking/damaged fuel tank. Check for evidence of fuel leaks.</p> <p>Check fuel level and if necessary, service fuel tank to red line on fuel strainer. Ensure fuel tank fill neck strainer is not clogged or damaged.</p> <p>The following fuels may be used between -51 and 122°F (-46 and 50°C):</p> <p>(a) DL-1 (A-A-52557) [-26° to 0°F (-32 to -18°C)]</p> <p>(b) DL-2 (A-A-52557) [0° to 122°F (-18 to 50°C)]</p> <p>(c) JP-8 (MIL-T-83133) [-26°F to -51°F (-32°C to -46°C)]</p>	Any fuel leaks, or damaged, loose, or missing parts.

Operator Preventive Maintenance Checks and Services - Continued

(1) Item No.	(2) Interval			(3) Item To Be Inspected	(4) Procedure	(5) Equipment Is Not Ready/Available If:
	B	D	A			
(8)	•			DIESEL ENGINE	<p>Ensure generator set is level and check diesel engine lubricating oil level using oil fill cap/dipstick (do not screw in oil fill cap/dipstick when checking oil level). Refer to Figure , item 8 for the locations of oil fill cap/dipstick. Add oil if required for the following operating environments: MIL-L-46167, OW30 [-40° to 0°F [-40° to -18°C]] MIL-L-2104, 15W40 [0° to 120°F [-18° to 49°C]]</p> 	
			•	Crankcase Oil		
	•	•	•		<p>Inspect the diesel engine and surrounding area for oil leaks.</p>	Class III oil leaks.

Operator Preventive Maintenance Checks and Services

(1) Item No.	(2) Interval			(3) Item To Be Inspected	(4) Procedure	(5) Equipment Is Not Ready/Available If:
	B	D	A			
(9)	•	•	•	Cylinder head cooling fins and recoil starter cover.	<p>Inspect cooling fins and air intake slots in recoil starter cover for damage and debris restricting air flow over and through cooling fins. Remove debris. Check recoil starter assembly for damage and operation.</p> 	Any damaged, loose, or missing parts.

Appendix C

Operation Under Usual/Unusual Conditions

OPERATION UNDER USUAL/UNUSUAL CONDITIONS

<u>Subject</u>	<u>Para.</u>
General	C.1
Assembly and Preparation for Use	C.2
Initial Adjustments and Checks	C.3
Operating Procedures	C.4
Identification and Instruction Plates	C.5
Preparation for Movement	C.6
Extreme Environmental Conditions	C.7
Nuclear, Biological, or Chemical Decontamination Procedures	C.8

C.1 . General.

This section provides information and guidance for generator set operation under normal conditions, refer to FM 20-31.

C.2 Assembly and Preparation for Use.

a. Installation of Ground Rods.

WARNING

Do not operate the generator set until it has been connected to a suitable ground. Serious injury or death can result from operating an ungrounded generator set.

1. Inset the ground cable (6 AWG min.) through the slot on the frame mounted terminal stud GND. Hold terminal body hex with one wrench and tighten terminal nut on the terminal stud.
2. Drive an eight foot (or longer) ground rod into the ground until the clamp on top of the ground rod is just above the surface.
3. Insert the ground cable through the ground rod clamp and tighten the clamp screw.

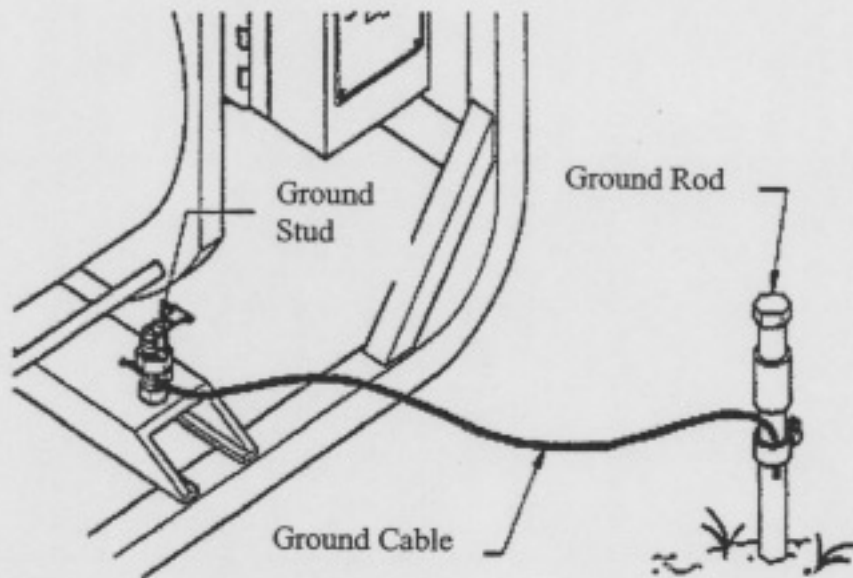


Figure C-1. Grounding Connections (Typical Installation)

b. Installation of Load Cables.

WARNING

Never attempt to connect or disconnect load cables while the generator set is running. Failure to observe this warning could result in severe personal injury or death by electrocution.

1. If operating, shut down the generator set and open load terminal board cover.
2. Using suitable wrenches, hold the terminal body hex with one wrench and loosen the terminal nuts (Figure C-2) on terminals "L" and "N".
3. Insert ends of load cables through the load cable exit. Then insert ends of cables in the slots of the load terminal studs.
4. Hold terminal body hex with one wrench and tighten load terminal nuts and lock the retaining clips. Then close and secure the load terminal board cover.

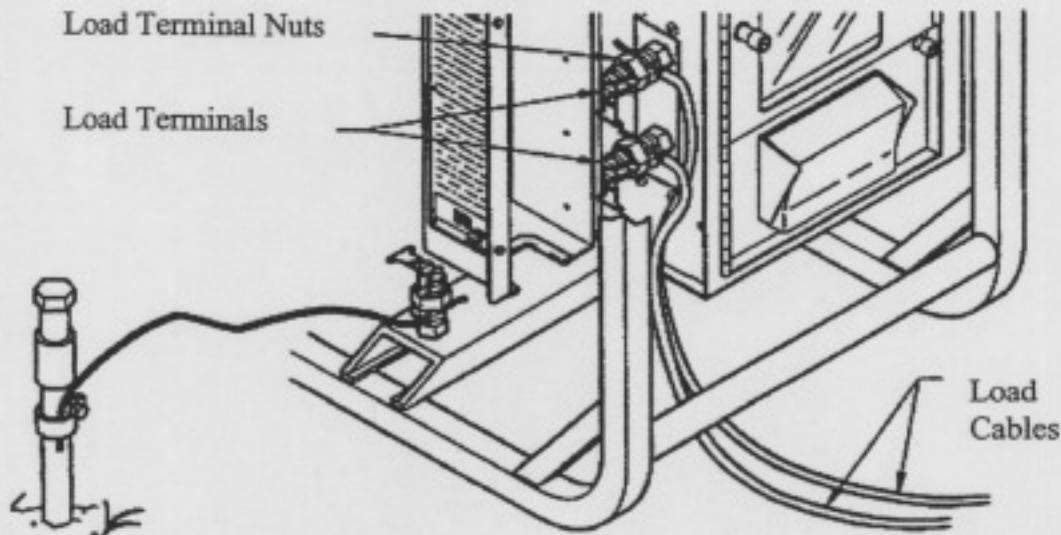


Figure C-2. Installation of Load Cables

c. Priming and Bleeding the Fuel System.

Under normal conditions, the fuel system does not require priming. Certain conditions may allow air into the fuel system, for example, running out of fuel. Once this occurs, the air must be bled before the engine will start or run smoothly. Using Figure C-3 proceed as follows:

WARNING

The fuels in this generator set are flammable. Use care when servicing or draining the fuel tank. Do not service or drain the fuel tank while open flames are present.

Use a container or cloth to catch the excess fuel to prevent spilling over engine components. Be sure to properly dispose of diesel fuel and diesel fuel soaked cloth.

1. Check that fuel tank has fuel and that fuel shutoff valve (Figure C-3) located on the filter is positioned to the open position.
2. Open the two bleed screws (Figure C-3) at the top of the filter in the order listed below.
 - a. Open left bleed screw to bleed air from tank to filter fuel line.
 - b. Open right bleed screw to bleed air from filter to pump fuel line. It may be necessary to squeeze the line by hand to force air out of bleed screw.
3. When fuel flows freely and evenly out of bleed screw (without air bubbles), tighten both bleed screws.
4. Loosen output fuel line fitting at fuel injection pump, place engine RUN lever to RUN position, depress and hold decompression lever, and pull recoil starter rope until fuel flows from around the fuel line fitting (without air bubbles). Tighten output fuel line.

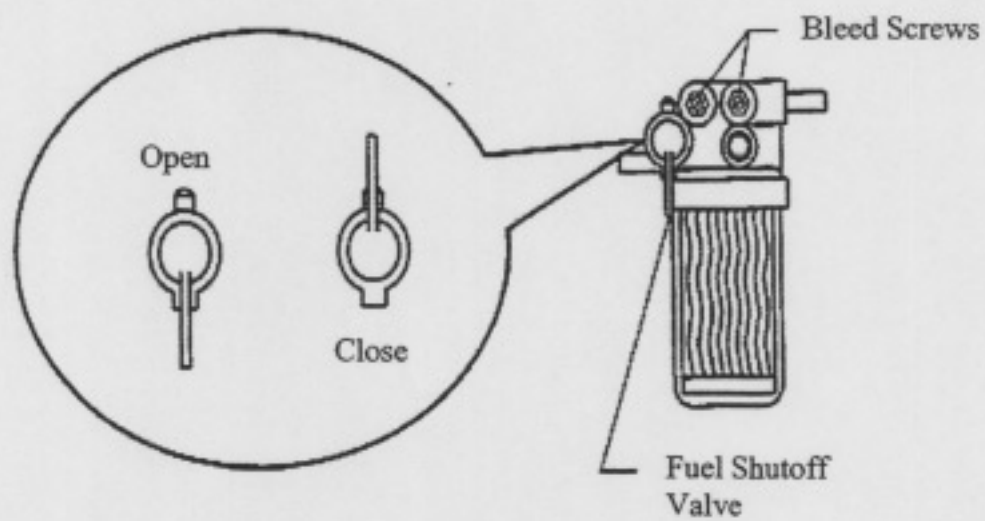


Figure C-3. Fuel Filter Bleed Screws

C.3 Initial Adjustments and Checks.

The diesel engine must be broken-in, avoiding heavy loads (no greater than 75%), for a period of at least twenty hours to ensure proper operation of the generator set. After the initial, break-in period, intake and exhaust valve clearances must be checked and adjusted, the head nuts torque must be checked, and engine lubricating oil changed. Contact unit maintenance.

C.4 Operating Procedures.

WARNING

High Voltage is produced when this generator set is in operation. Use care when working around an open control panel with the generator set operating. Improper operation and/or failure to follow this warning could result in personal injury or death by electrocution.

WARNING

Exhaust discharge contains deadly gases. Do not operate generator set in enclosed area unless exhaust discharge is properly vented outside. Position as far away from personnel, shelters, and occupied vehicles as possible. Failure to observe this warning could result in severe personal injury or death due to carbon monoxide poisoning.

WARNING

The noise level of this generator set when operating could cause hearing damage. Hearing protective devices must be worn when operating or working within 13 feet of the generator set when it is running. Failure to observe this warning can result in personal injury.

CAUTION

If the diesel engine starts racing (overspeeding) at startup or during operation, there is a governor control malfunction. Depress the engine STOP lever immediately to avoid possible damage to the diesel engine caused by excessive overspeeding.

NOTE

Under normal operating conditions, the generator set will vibrate and "walk" on hard surfaces. Block the generator set appropriately.

- a. Manual Starting (23 to 122 degrees).

WARNING

Do not operate the generator set until it has been connected to a suitable ground. Serious injury or death can result from operating an ungrounded generator set.

1. Ground generator set, refer to paragraph C.2a.
2. Switch ON-OFF load circuit breaker (10, Figure 1-1) to OFF.

WARNING

Never attempt to connect or disconnect load cables while the generator set is running. Failure to observe this warning could result in severe personal injury or death by electrocution.

3. Connect the load cables to the load terminals, refer to paragraph C.2b.
4. Perform all B (Before) PMCS procedures, refer to Appendix B.
5. Check that the air intake cover (2) is in the Normal operating (summer) position as indicated on tip of filter cover (Figure C-4).
6. Turn fuel shutoff valve (6, Figure 1-1) to the open position.
7. Pull the recoil starter (1) slowly. Stop when it feels tight.
8. Depress decompression lever "A" (3).
9. Move engine RUN lever (4) to RUN position (Figure C-5).

CAUTION

A condition known as reverse rotation can occur if the recoil starter rope (1, Figure 1-1) is pulled out too slowly. If the engine rotation reverses, you will hear abnormal noises caused by the reverse rotation of the oil pump. **DEPRESS THE ENGINE STOP LEVER IMMEDIATELY.** Failure to do so will cause the engine bearings to seize due to lack of lubrication.

10. Take up the slack in the recoil starter rope (1) and pull the rope quickly and all the way out.

11. If the engine fails to start, repeat steps 7 thru 10.
12. If the engine still fails to start after two attempts, refer to operator troubleshooting tables in Appendix D.
13. Check all gauges for proper indication as follows, refer to Figure 1-1:

NOTE

If any gauge indicates an improper value, refer to the operator troubleshooting tables in Appendix D.

- a. Volts AC meter (12), 120 VAC.
- b. Hertz frequency meter (8), 60 – 63 Hz.
- c. % Load meter (13), under no load 0%. The reading will vary as the demand changes (from 0 to 125%).

NOTE

Under normal conditions, allow the diesel engine to warm-up for five minutes before applying a load. If necessary, the load can be applied immediately.

14. Switch ON-OFF load circuit breaker (10, Figure 1-1) to ON to apply load.
15. Perform all D (During) PMCS procedures in accordance with Appendix B.

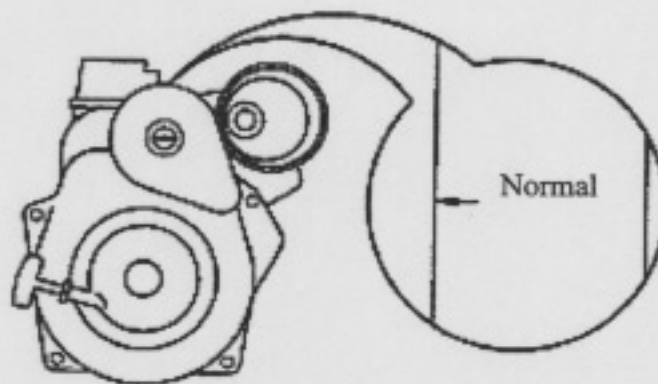


Figure C-4. Air Intake Cover, Normal Operation

b. Electric Starting (23 to 122 degrees).

1. Ground generator set, refer to paragraph C-2a.
2. Switch ON-OFF load circuit breaker (10, Figure 1-1) to OFF.

WARNING

Never attempt to connect or disconnect load cables while the generator set is running. Failure to observe this warning could result in severe personal injury or death by electrocution.

3. Connect load cables to the load terminals, refer to paragraph C-2b.
4. Perform all B (Before) PMCS procedures, refer to Appendix B.
5. Check that the air intake cover is in the Normal operating (summer) position as indicated on the top of the filter cover (Figure C-4).
6. Turn fuel shutoff valve (6, Figure 1-1) to the open position.

CAUTION

Do not crank engine more than 10 seconds without allowing the starter to cool for at least 15 seconds between starts. Over cranking can damage the starter.

7. Connect a 24 VDC battery source to the NATO slave receptacle (11).
8. Move the engine RUN lever (4) to the RUN position (Figure C-5).
9. Turn START-PREHEAT/PREHEAT/OFF/START switch (9, Figure 1-1) to clockwise to START position. Release switch when engine starts.
10. If diesel fails to start, repeat steps 8 and 9.
11. If engine still fails to start after two attempts, refer to the operator troubleshooting tables in Appendix D.
12. Disconnect 24 VDC battery source from NATO slave receptacle (11).
13. Check all gauges for proper indication as follows:

NOTE

If any gauge indicates an improper value, refer to the operator troubleshooting tables in Appendix D.

- a. Volts AC meter (12), 120 VAC.
- b. Hertz frequency meter (18), 60 – 63 Hz.
- c. % Load meter (13), under no load 0%. The reading will vary as the demand changes (from 0 to 125%).

NOTE

Under normal conditions, allow the diesel engine to warm-up for five minutes before applying a load. If necessary, the load can be applied immediately.

- 14. Switch ON-OFF load circuit breaker (10, Figure 1-1) to ON to apply the load.
 - 15. Perform all D (During) PMCS procedures in accordance with Appendix B.
- c. Electric Starting (23 to –5 degrees).
- 1. Ground generator set, refer to paragraph C-2a.
 - 2. Switch ON-OFF load circuit breaker (10, Figure 1-1) to OFF.

WARNING

Never attempt to connect or disconnect load cables while the generator set is running. Failure to observe this warning could result in severe personal injury or death by electrocution.

- 3. Connect load cables to the load terminals, refer to paragraph C-2b.
- 4. Perform all B (Before) PMCS procedures, refer to Appendix B.
- 5. Turn fuel shutoff valve (6, Figure 1-1) to the open position.
- 6. Connect a 24 VDC battery source to the NATO slave receptacle (11).
- 7. Move the engine RUN (4) lever to the RUN position (Figure C-5).

8. Turn START-PREHEAT/PREHEAT/OFF/START switch (9, Figure 1-1) counterclockwise to PREHEAT position for 1-1/2 minutes.

CAUTION

Do not crank engine more than 10 seconds without allowing the starter to cool for at least 15 seconds between starts. Over cranking can damage the starter.

9. Turn START-PREHEAT/PREHEAT/OFF/START switch (9, Figure 1-1) to clockwise to START position. Release switch when engine starts.
10. If diesel fails to start, repeat steps 8 and 9.
11. If engine still fails to start after two attempts, refer to the operator troubleshooting tables in Appendix D.
12. Disconnect 24 VDC battery source from NATO slave receptacle (11).
13. Check all gauges for proper indications as follows:

NOTE

If any gauge indicates an improper value, refer to the operator troubleshooting tables in Appendix D.

- a. Volts AC meter (12), 120 VAC.
- b. Hertz frequency meter (18), 60 – 63 Hz.
- c. % Load meter (13), under no load 0%. The reading will vary as the demand changes (from 0 to 125%).

NOTE

Under normal conditions, allow the diesel engine to warm-up for five minutes before applying a load. If necessary, the load can be applied immediately.

14. Switch ON-OFF load circuit breaker (10, Figure 1-1) to ON to apply the load.
15. Perform all D (During) PMCS procedures in accordance with Appendix B.

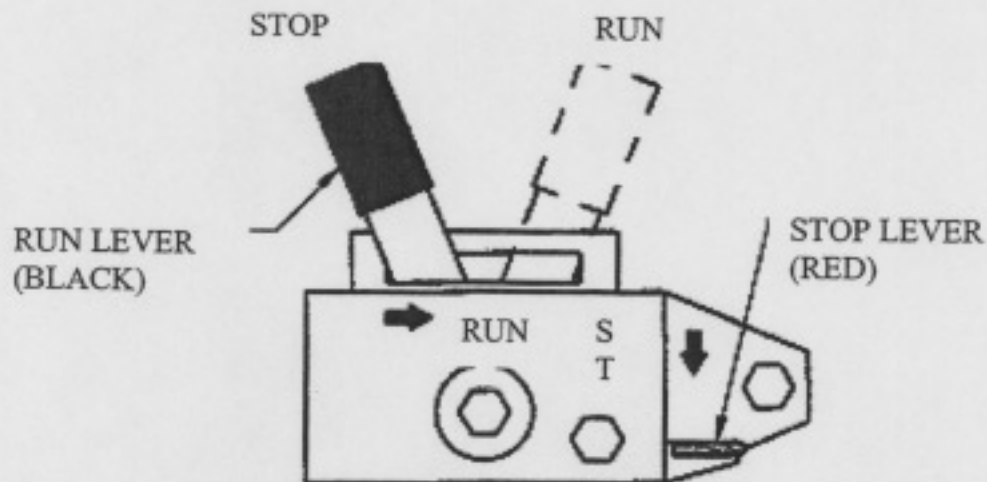


Figure C-5. Engine RUN and STOP Controls

d. Electric Starting (-5 degrees and below).

1. Ground generator set, refer to paragraph C-2a.
2. Switch ON-OFF load circuit breaker (10, Figure 1-1) to OFF.

WARNING

Never attempt to connect or disconnect load cables while the generator set is running. Failure to observe this warning could result in severe personal injury or death by electrocution.

3. Connect load cables to the load terminals, refer to paragraph C-2b.
4. Perform all B (Before) PMCS procedures, refer to Appendix B.
5. Turn fuel shutoff valve (6, Figure 1-1) to the open position.
6. Connect a 24 VDC battery source to the NATO slave receptacle (11).
7. Move the engine RUN lever (4) to the RUN position (Figure C-5).

8. Turn air intake cover (2, Figure 1-1) to COLD position, refer to Figure C-6.
9. Turn START-PREHEAT/PREHEAT/OFF/START switch (9, Figure 1-1) counterclockwise to PREHEAT position for 3 minutes

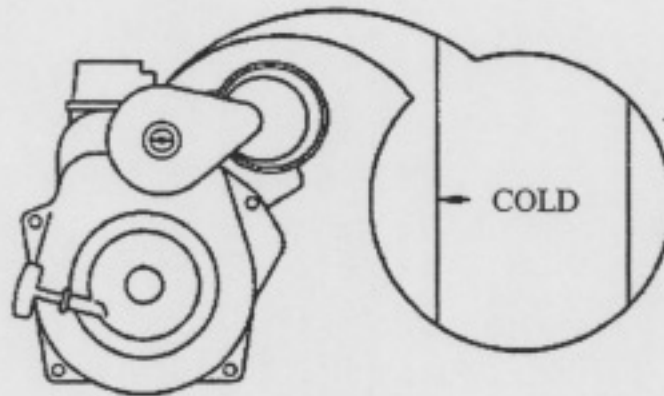


Figure C-6. Air Intake Cover, Cold Operation

CAUTION

Be sure to install the rubber plug (Figure C-7) in the cylinder head cover opening after adding oil. Leaving the hole unplugged can lead to premature diesel engine failure as water, dirt, and debris entering the hole can damage internal parts. Do not add more than the specified amount of engine oil through the cylinder head cover.

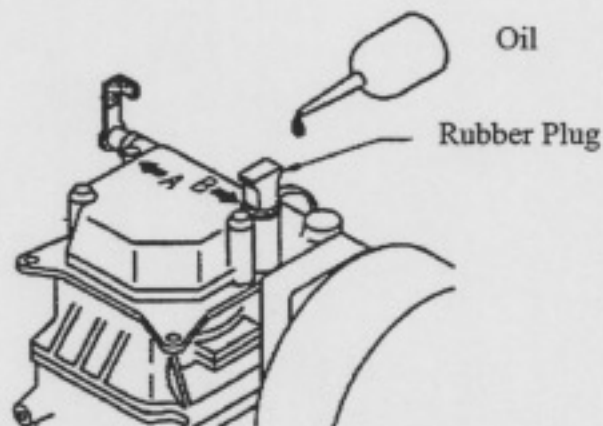


Figure C-7. Adding Oil – Cylinder Head Cover Opening

10. Remove rubber Plug "B" (Figure C-7) in cylinder head cover and add 2ml of clean engine oil, MIL-L-2104, 15W40. Install rubber plug.

CAUTION

Do not crank engine more than 10 seconds without allowing the starter to cool for at least 15 seconds between starts. Over cranking can damage the starter.

11. Turn START-PREHEAT/PREHEAT/OFF/START switch (9, Figure 1-1) to counterclockwise to START-PREHEAT position. Release switch when engine starts.
12. If diesel fails to start, repeat steps 9 and 11.
13. Disconnect 24 VDC battery source from NATO slave receptacle (11).
14. Check all gauges for proper indication as follows:

NOTE

If any gauge indicates an improper value, refer to the operator troubleshooting tables in Appendix D.

- a. Volts AC meter (12), 120 VAC.
- b. Hertz frequency meter (18), 60 – 63 Hz.
- c. % Load meter (13), under no load 0%. The reading will vary as the demand changes (from 0 to 125%).

NOTE

Under normal conditions, allow the diesel engine to warm-up for five minutes before applying a load. If necessary, the load can be applied immediately.

15. Switch ON-OFF load circuit breaker (10, Figure 1-1) to ON to apply the load.
16. Perform all D (During) PMCS procedures in accordance with Appendix B.

e. Stopping Procedure.

1. Switch ON-OFF load circuit breaker (10, Figure 1-1) to OFF position and allow engine to run approximately 3 minutes with no load.
2. Press engine STOP lever (5).
3. Turn fuel shutoff valve (6) to the closed position.
4. Perform all A (After) PMCS procedures in accordance with Appendix B.

C.5 Identification and Instruction Plates.

There are identification and instruction plates on the generator set. Use TM 9-6115-673-13&P, Figure 2-9 for the location and contents of each plate on the generator set.

C.6 Preparation for Movement.

- a. Shut down generator set. Refer to paragraph C.4e.
- b. Disconnect load cables (Figure C-2).
- c. Disconnect ground cable (Figure C-1) and remove ground rods.
- d. Secure all generator set access doors and panels.
- e. For initial set up after movement, refer to paragraph C.2 for assembly and preparation for use.

C.7 Extreme Environmental Conditions.

a. Operation in Extreme Cold (23 to -51 degrees).

The generator is designed for use in ambient temperatures as low as -51 degrees. To ensure satisfactory operation, the following steps should be taken.

1. When possible, provide shelter from winds, freezing rain, and drifting snow. Position generator set behind a wind barrier.
2. When operated in an enclosed area, be sure that proper provisions are made for removal of exhaust gases.

CAUTION

Be careful not to scrape, scratch, gouge, or in any way damage the generator set. Avoid moving wiring as much as possible.

3. Remove accumulated snow or ice, if possible, by moving the generator set to a heated enclosure and allow the accumulation to melt after first wiping or brushing away loose deposits. When a heated enclosure is not available, remove snow or ice by wiping, brushing, or carefully picking the deposits away.
4. For extreme cold weather conditions, MIL-L- 46167, 0W30 oil is recommended.

WARNING

Avoid contacting metal items with bare skin in extreme cold weather. Failure to observe this warning can result in personal injury.

5. Keep fuel tank at least $\frac{3}{4}$ full during cold weather operations.
- b. Operation in Extreme Heat (Above 120 degrees).
1. When operating in extremely hot temperatures, attempt to place the generator set in a shaded area.
 2. Provide as much ventilation as possible.
 3. Keep all engine air passages and end cover openings clean and free of obstructions.
 4. Make sure that the air intake cover (12, Figure 1-1) is turned so that ambient air is directed to the air intake, see Figure C-4.
 5. Do not completely fill the fuel tank. Leave one inch for fuel expansion.
 6. Use MIL-L-2104 GR OE/HDO-30 lubricating oil in the diesel engine crankcase.
- c. Operation in Dusty or Sandy Areas.
1. Shield generator set from dust and sand.

2. Clean dust and dirt from the generator set as required. Do not allow dust to accumulate around the generator set.
 3. Inspect and clean secondary (outer) air intake filter.
 4. Keep generator air inlet and outlet slots clean.
 5. Carefully remove dust and sand from control panel.
 6. Keep area around fuel tank clean and free from dust and sand.
- d. Operation in Rainy or Humid Conditions.
1. When not in use, cover generator set with canvas or other waterproof material. Remove cover during dry periods to allow unit to dry out.
 2. Keep fuel tank full to prevent condensation.
- e. Operation in Salt Water Areas.

CAUTION

Salt water is harmful to paint and is particularly corrosive when allowed to remain in contact with exposed metal.

1. Cover generator set with canvas or other material when it is not in use.
 2. Wipe generator set down frequently with fresh water and allow it to dry thoroughly.
- f. Operation at High Altitudes.

NOTE

The generator set is designed to produce 2kW continuous at elevations up to 4000 feet above sea level, 95 degrees ambient and 30 to 70% relative humidity without special service or adjustment.

- g. Derating Generator Set Output for High Altitudes and Temperatures.
1. To run the set at a higher altitude, derate output 1.3% for every 328 feet.
 2. Provide adequate ventilation as the engine is more likely to overheat at high altitudes.

3. When operating in high temperatures, derate 3% for every 50 degrees above 95 degrees (Refer to Table C-1).

Table C-1. Altitude and Temperature Derating Calculation

Altitude Deration = $\frac{\text{Altitude} - 4000 \text{ feet} \times (0.013) \times (2000W)}{328 \text{ feet}}$
Temperature Deration = $\frac{\text{Temperature} - 95 \text{ degrees} \times (0.03) \times (2000W)}{50 \text{ degrees}}$
Total Deration = $2000W - \text{Altitude Deration} - \text{Temperature Deration}$

C.8 Nuclear, Biological, and Chemical Decontamination Procedures.

- a. The generator set is capable of being operated by personnel wearing nuclear, biological, or chemical (NBC) protective clothing without special tools or support equipment. Refer to FM 3-5, NBC Decontamination for information on decontamination procedures. Specific procedures for the generator set are the following.
- b. Control panel indicators sealing gaskets, control panel door gaskets, access door gaskets, rubber tubing, coverings for electrical conduits, and retaining cord for slave receptacle cover will absorb and retain chemical agents. Replacement of these items is the recommended method of decontamination.
- c. Lubricants and fuel may be present on the external surfaces of the generator set or components due to leaks or normal operation. These fluids will absorb NBC agents. The preferred method of decontamination is removal of these fluids using conventional decontamination methods in accordance with FM 3-5.
- d. Continued decontamination of external generator set surfaces with supertropical bleach (STB) and decontaminating solution number 2 (DS2) will degrade clear plastic indicator coverings to a point where reading the indicators will be come impossible. This problem will become more evident for soldiers wearing protective masks. The use of STB and DS2 decontaminants in these areas should be minimized. Indicators should be decontaminated with warm, soapy water.
- e. External surfaces of the control panel assembly that are marked with painted or stamped lettering will not withstand repeated decontamination with STB or DS2 without degradation of this lettering. The recommended method of decontamination for these areas is warm, soapy water.

- f. Areas that will entrap contaminants, making efficient decontamination extremely difficult, include the following: space behind knobs and switches on the control panel, exposed heads of screw, areas adjacent to and behind exposed wiring conduits, hinged areas of access doors, spaces behind externally mounted equipment data plates, retaining cords for external receptacle covers, areas behind GFCI receptacle cover, access panel locking mechanisms, fuel cap, load output terminal board access door, NATO slave receptacle, frequency adjustment controls, areas around tie-down /lifting points, crevices around access doors, and external screens covering ventilation areas. Replacement of these items, if available, is the preferred method decontamination. Conventional decontamination methods should be used on these areas, while stressing the importance of thoroughness and the probability of some degree of continuing contact and vapor hazard.
- g. The use of overhead shelters, or chemical protective covers is recommended as an additional means of protection against contamination in accordance with FM 3-5. If using covers, care should be taken to provide adequate space for airflow and exhaust.
- h. For additional NBC information, refer to FM 3-3 and 3-4.

Appendix D

Troubleshooting/Operator Maintenance Procedures

D.1 Operator Troubleshooting Procedures.

a. Purpose of Logic Tree Table.

Troubleshooting Tables list common malfunctions that you may find with your equipment. Perform the tests, inspections, and corrective actions in the order they appear in the table. The troubleshooting tables cannot list all the malfunctions that may occur, all the tests and inspections needed to find the fault, or all the corrective actions needed to correct the fault. If the equipment malfunction is not listed or actions listed do not correct the fault, notify your supervisor.

NOTE

Before you use these procedures, be sure that all PMCS procedures have been performed.

b. Symptom Index.

Symptom	Table
Diesel Engine Will Not Start (Manual Starting)	D-1
Diesel Engine Will Not Start (Electric Starting)	D-2
Diesel Engine Runs Rough	D-3
Voltage Output Drops	D-4
Generator Set Vibrating/Bouncing Excessively	D-5
No Voltage Indication on Volts Meter (M2)	D-6
Voltage Indication on Volts Meter (M2) is High, Low, or Fluctuating	D-7
No Indication on %Load Meter (M1) with Load Applied	D-8
No Indication on Hertz Frequency Meter (M4)	D-9
Hours Meter (M3) Not Operating	D-10
Excessive Voltage Drop when Applying Load	D-11

Table D-1. Diesel Engine Will Not Start (Manual Starting)

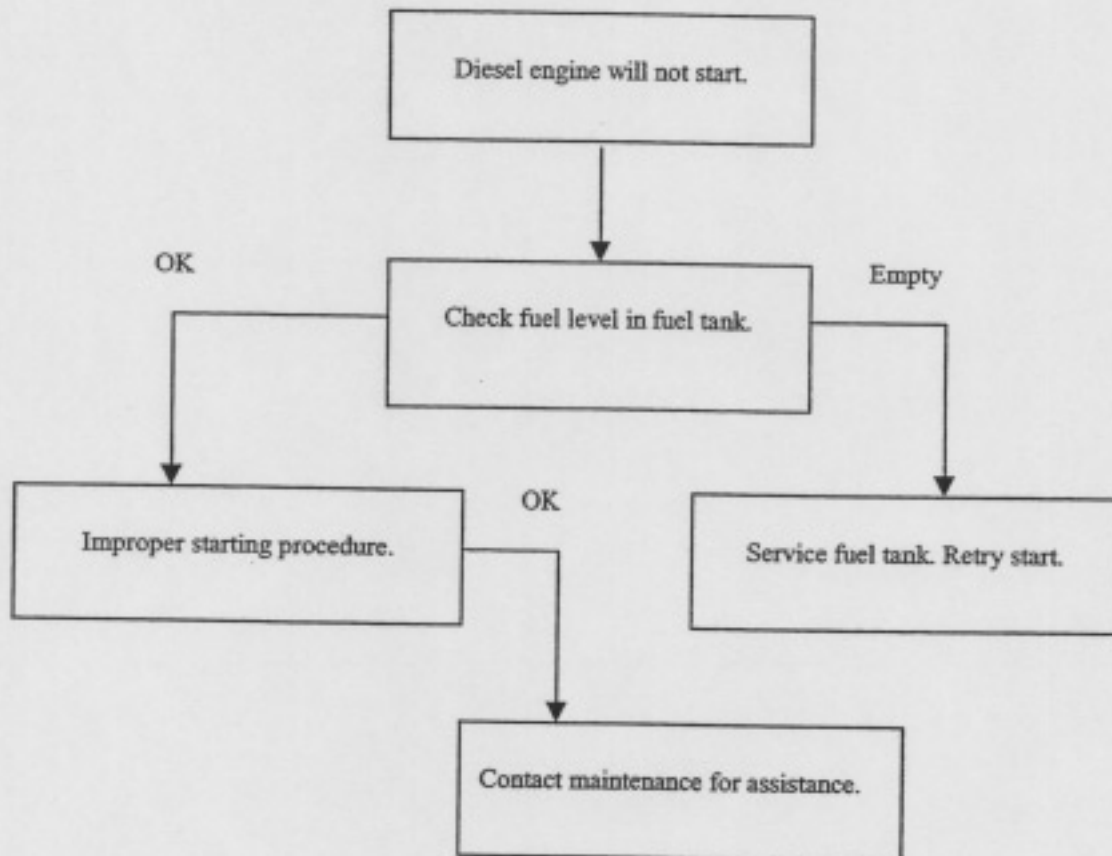


Table D-2. Diesel Engine Will Not Start (Electric Starting)

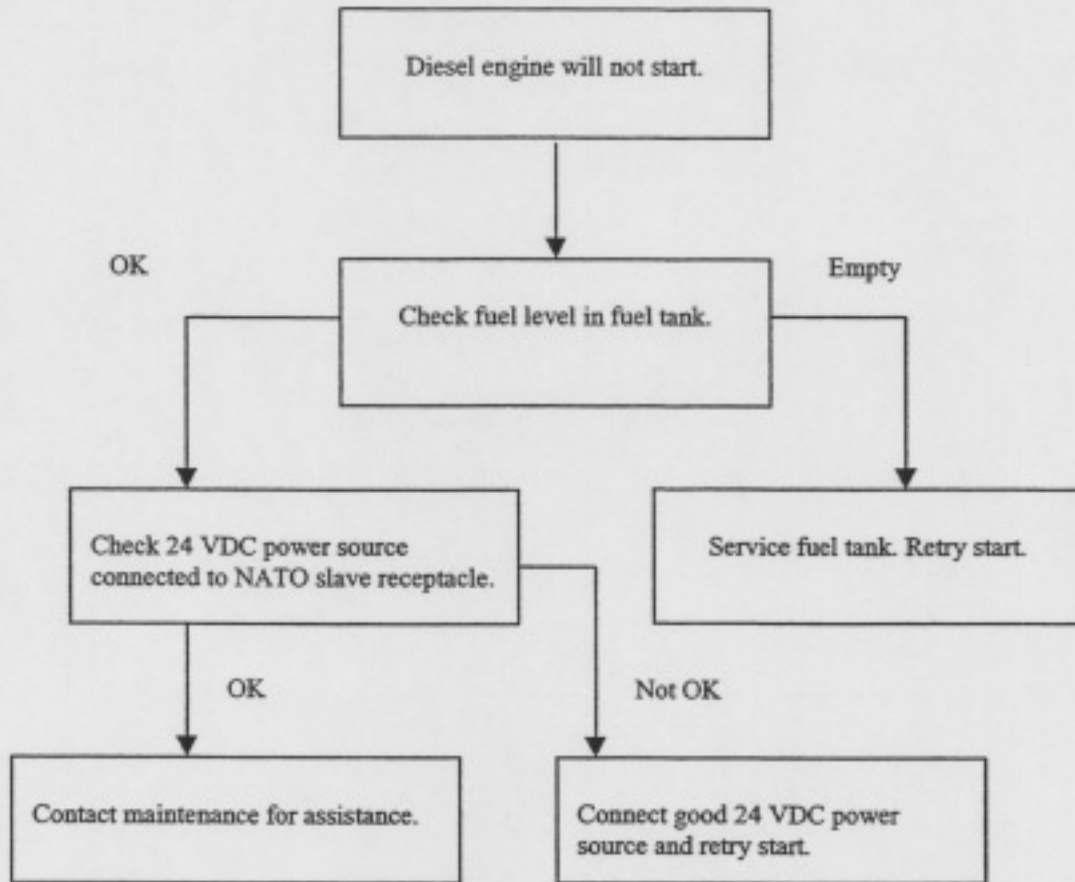


Table D-3. Diesel Engine Runs Rough

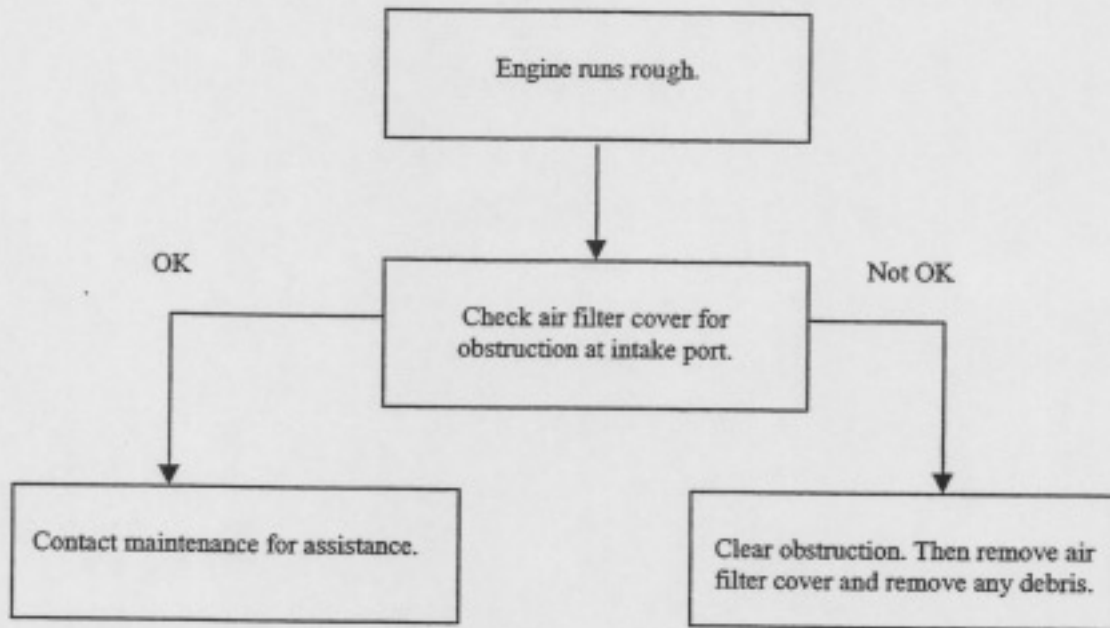


Table D-4. Voltage Output Drops

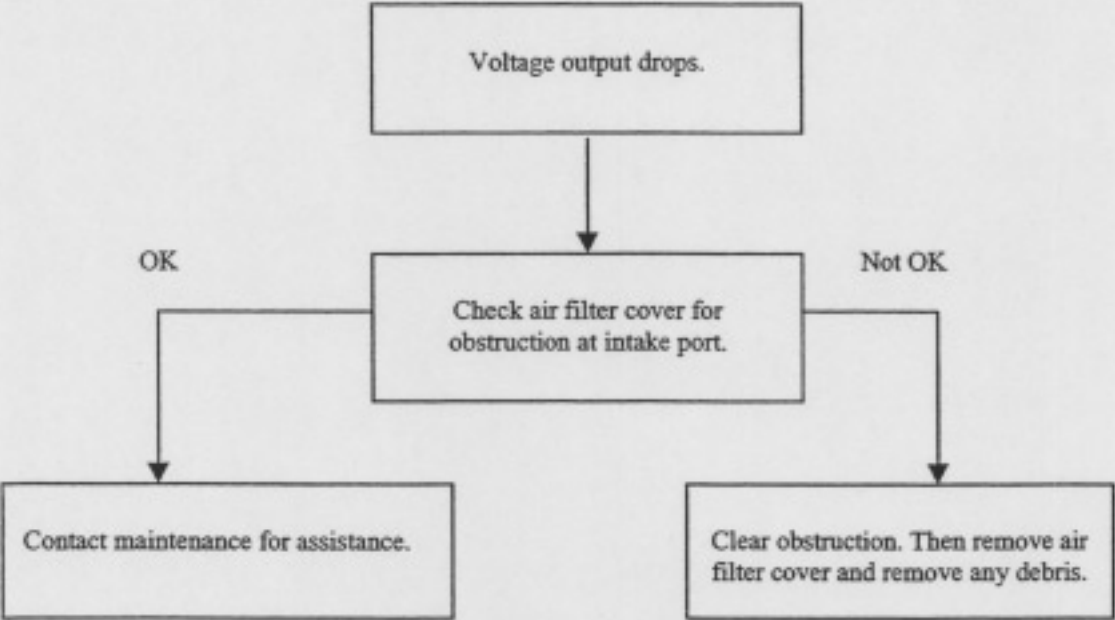


Table D-5. Generator Set Vibrating/Bouncing Excessively

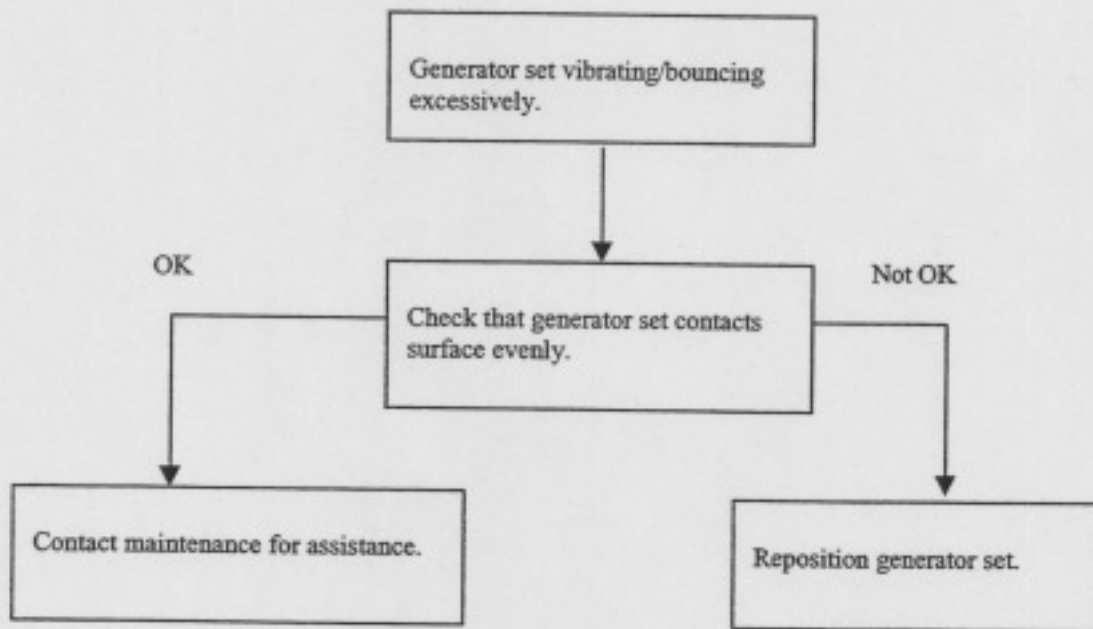


Table D-6. No Voltage Indication on VOLTS Meter (M2)

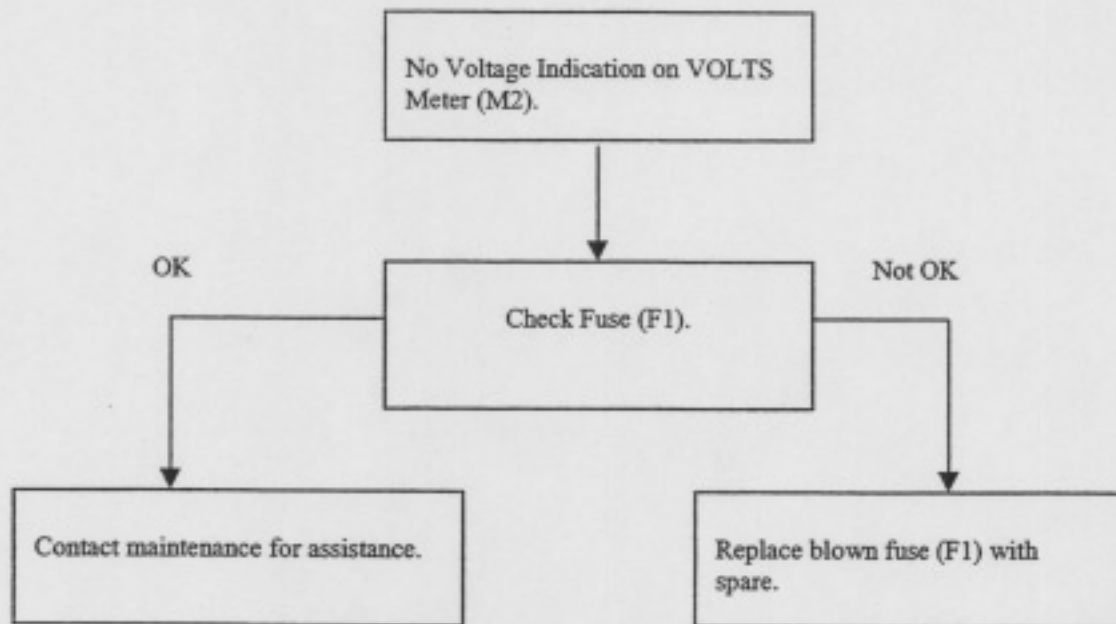


Table D-7. Voltage Indication on VOLTS Meter (M2) is High, Low, or Fluctuating

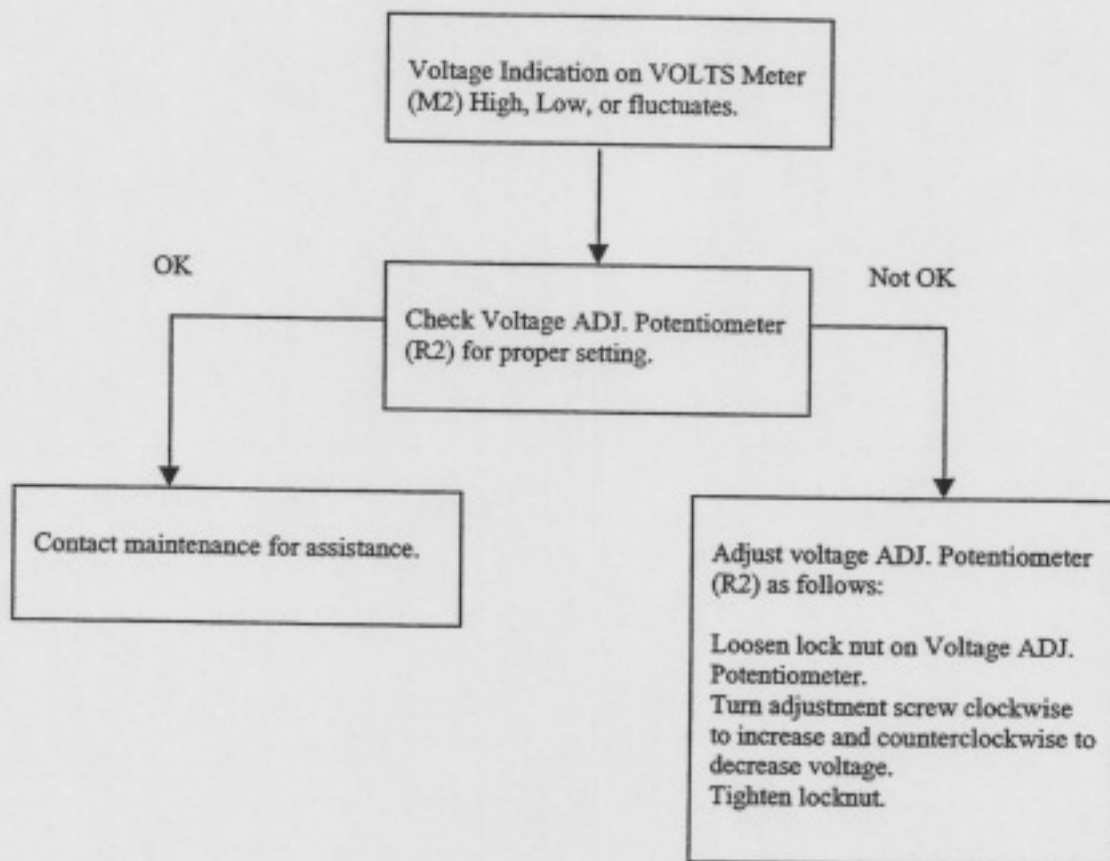


Table D-8. No Indication on % LOAD Meter (M1) With Load Applied

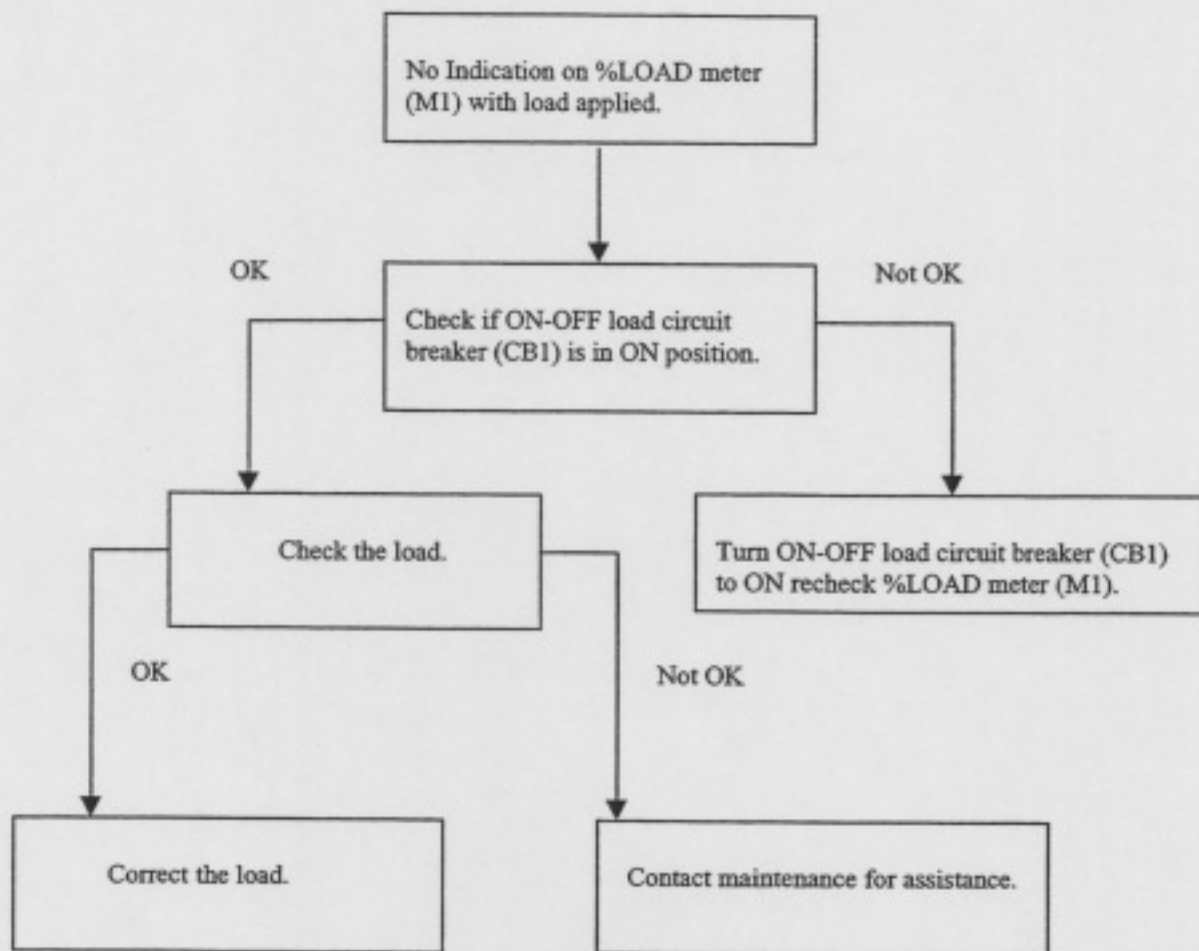


Table D-9. No Indication on HERTZ Frequency Meter (M4)

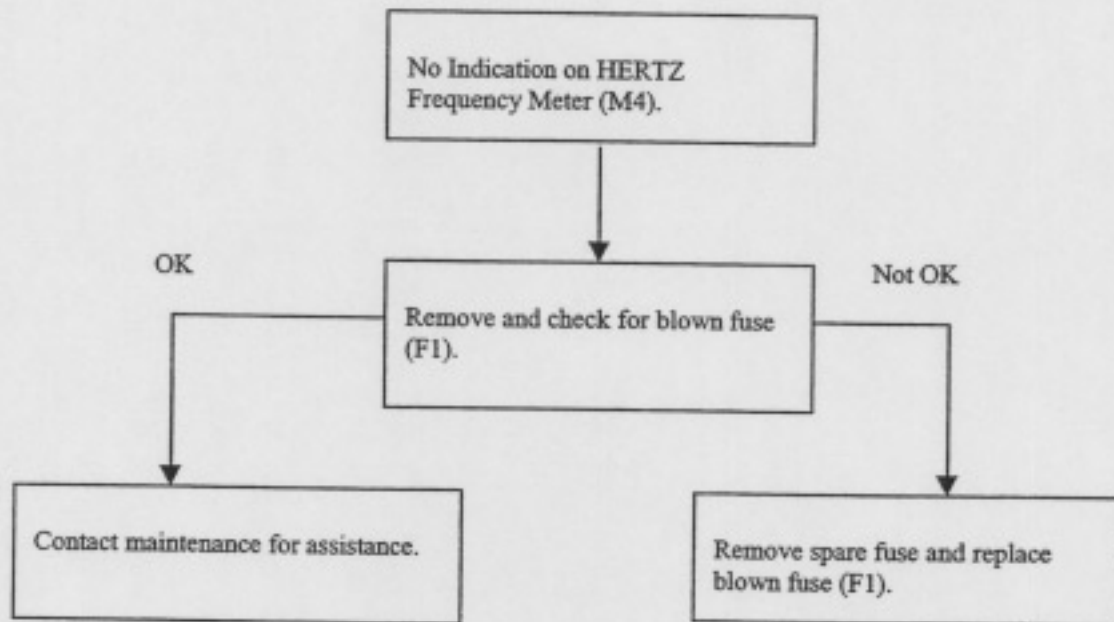


Table D-10. HOURS Meter (M3) Not Operating

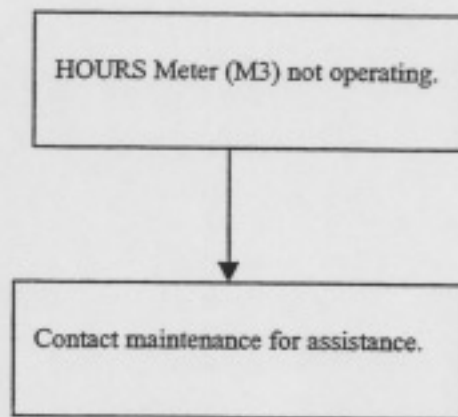
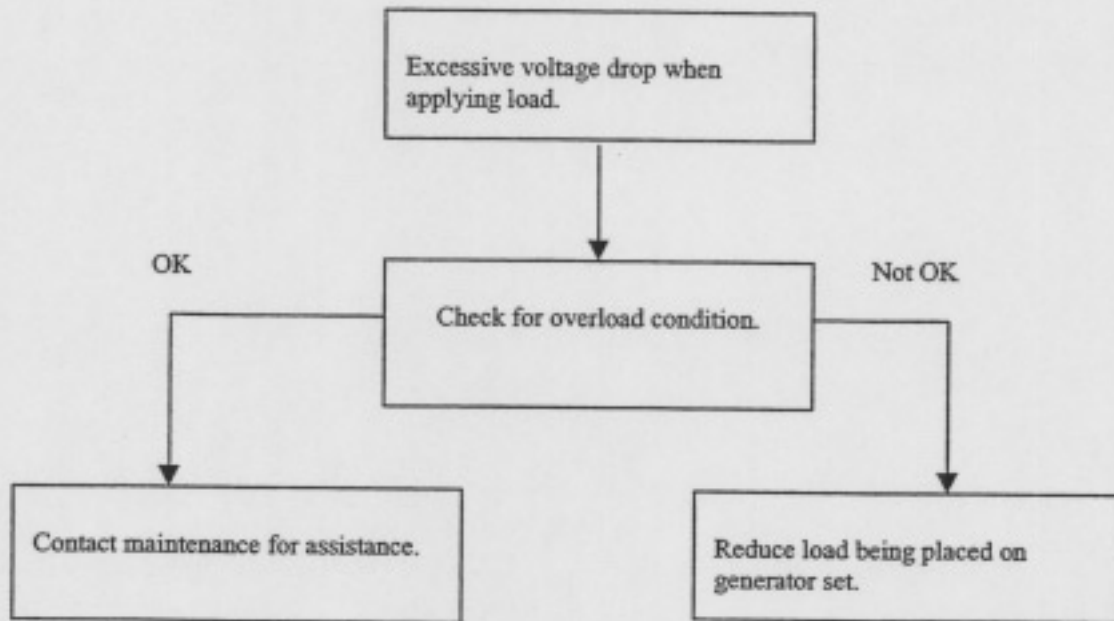


Table D-11. Excessive Voltage Drop When Applying Load



D.2 Instrument Fuse.

a. Removal.

1. Shut down generator set.
2. Release instrument cover by turning fastener, open instrument cover.
3. Remove cap and fuse (Figure D-1).

b. Inspection.

1. Inspect fuse (Figure D-1) for cracks and burned out element. Discard fuse if defective. If necessary, remove spare fuse from spare fuse holder.

NOTE

If there is no fuse in the spare fuse holder, contact maintenance for the proper replacement.

2. Inspect contacts in cap and fuse holder for evidence of corrosion and damage. If corroded or damaged, contact Unit maintenance for repair.

c. Installation.

1. Insert fuse into fuse holder and install cap (Figure D-1).
2. Close and secure instrument cover.

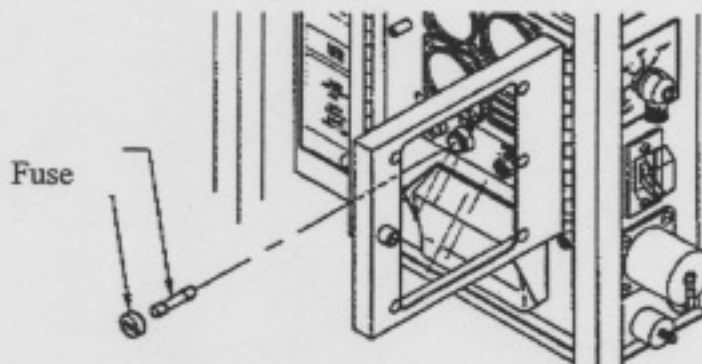


Figure D-1. Fuse (F1) Replacement Cap

Appendix E

Reference

TM 9-6115-673-13&P

2kW Military Tactical Generator Set

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Controls and Indicators	Page 2-1, para. 2.2
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FM 21-11

First Aid for Soldiers

FM 20-31

Electric Power Generation in the Field